APPENDIX 5-11

HEC-RAS INPUT AND OUTPUT FILES WITH DESCRIPTION

South Florida Water Management District
EAA Reservoir A-1 Basis of Design Report   January, 2006

1.   HEC-RAS DAM BREACH MODELMODEL INPUT AND ASSUMPTIONS

The basic geometric data of establishing the connectivity of the river system (River System Schematic); cross section data; reach lengths; energy loss coefficients (friction losses, contraction and expansion losses); and stream junction information. To simulate a dam breach, the cross-sections upstream from the embankment must contain the appropriate elevation to storage relationship as the modeled reservoir. This can either be done by cutting actual cross-sections through the reservoir or by setting up pseudo cross sections which correctly simulate the elevation-storage curves. If dynamic reservoir routing through the lake is of interest, utilizing actual cross sections is more appropriate. For the EAA dam breach model detailed in the *PMP/PMF Summary Technical Memorandum (Draft) (*Schlaman 2005, See Appendix 5-2), four pseudo cross sections were entered to simulate the stage vs. storage relationship for the A-1 reservoir.

Cross sections are located at intervals along a stream to characterize the flow carrying capability of the stream and its adjacent floodplain. The interval lengths between cross sections are termed reach lengths. The cross sections span the entire floodplain and are perpendicular to the flow. Additional cross sections are required at points which changes in discharge, slope, shape, roughness, or structures occur. An example of a cross section model entry is shown in Figure 1. For the EAA dam breach model, the downstream cross sections from the A-1 reservoir were set to expand at a 3:1 ratio to simulate the expansion of the floodwave, and were set to have zero slope. Furthermore, a Manning's value of 0.03 was used for the roughness of the downstream reaches.

Upstream and downstream initial conditions (flow and stage) are needed to perform unsteady flow analysis. The upstream conditions can be described by elevation data, inflow hydrograph coordinates, or a combination of both. The downstream boundary conditions include the same choices as the upstream but also have an option for normal depth. In most cases, the water surface elevation at the downstream boundary of the model is not normally known.   This parameter must be estimated for each profile to be computed. The Manning's equation is used to calculate normal depth to use as a starting water surface elevation. For the EAA dam breach model, the downstream boundary condition was set to "normal depth" with a slope of 0.001 ft/ft. The upstream boundary condition used was a hydrograph set to zero inflow.

Dynamic routing models can have stability problems when modeling complex systems so maintaining simplicity while accurately modeling the system is important. Once the hydraulic information, boundary conditions, and dam breach assumptions are input, a simulation of a dam breach can be performed. The model allows the user to choose a run time and time step for computations. Choosing a smaller time step and increasing the number of model cross section typically increases the models stability. The A-1 dam breach model time step was set to 1 minute,   while   the   detailed   output   was   set   at   15-minute   intervals.

The breach parameters selected to simulate an A-1 dam breach were developed by an iterative process. This process is provided in detail in the *PMP/PMF Summary Technical Memorandum (Draft)* (Schlaman 2005, See Appendix 5-2).

2.   MODEL OUTPUT

After the model has finished the steady or unsteady flow computations the output may be viewed. Output is available in a graphical and tabular format. Graphically, one may view the cross sections, profiles, rating curves, hydrographs, X-Y-Z perspective plots, detailed tabular output at a singe location, and limited tabular output at many cross sections. One can also develop their own tabular output tables.

HEC-RAS output includes water surface elevation, hydraulic grade line, velocity, and various other hydraulic data. When simulating a DAM BREACH by utilizing the unsteady flow portions of the program, the following output data is of interests: peak outflow from breach, floodwave arrival time, peak water surface elevation, and time of recession. The complete list of output parameters may be referenced in the HEC-RAS User Manual sown in Appendix 5-10. The printouts included here-in provides a complete list of DAMBRK runs made for the EAA dam breach modeling discussed in *PMP/PMF Summary Technical Memorandum (Draft)* (Schlaman 2005) (See Appendix 5-2). A copy of the HEC-RAS program and input/output files can be found in Appendix 5-12.

Ouput Table 1

Scenario	Initial WSE (Relative ft)	Elev of Center of Breach (ft)	Breach Width (ft)	Failure Time (hrs)	Avg Failue Speed (ft/s)	Max Flow @ Dam (cfs)	Distance of 2 ft Limit from Reservoir Breach (ft)	Outlfow Velocity At End of Assumed Failure Time (ft/s)	Reservoir Elevation At End of Assumed Failure Time (Relative ft)
1	16.5	0	11,944	6.635	0.5	519,231	77,200	1.7	6.9
2	16.5	0	11,944	13.27	0.25	371,780	77,100	0.96	4.6
3	16.5	6	11,944	13.27	0.25	362,782	77,100	0.93	4.63
4	16.5	6	10,000	11.11	0.25	369,594	78,900	1.33	5.42
5	16.5	6	10,000	5.55	0.5	514,633	79,000	2.16	7.73
6	16.5	6	5,000	5.55	0.25	349,933	82,300	3.85	9.44
7	16.5	6	5,000	2.77	0.5	438,090	82,300	5.33	11.85
8	16.5	6	5,000	1.85	0.75	485,974	82,400	6.15	12.18
9	16.5	6	5,000	1.38	1	515,106	82,400	6.77	13.68
10	16.5	6	5,000	2	0.69	478,011	82,300	5.86	12.61
11	16.5	6	5,000	4	0.35	388,404	82,300	4.08	9.88
12	16.5	6	5,000	6	0.23	341,058	82,200	3.81	9.35
13	16.5	6	5,000	8	0.17	305,806	82,200	3.25	8.3
14	16.5	6	2,500	2	0.35	318,822	81,400	9.36	14.4
15	16.5	6	2,500	4	0.17	267,200	81,400	7.86	12.87
16	16.5	6	2,500	6	0.12	232,755	81,400	6.83	11.6
17	16.5	6	2,500	8	0.09	207,873	81,400	5.9	10.35
18	16.5	6	1,000	2	0.14	160,346	75,800	13.03	15.57
19	16.5	6	1,000	4	0.07	147,810	75,900	12.12	14.56
20	16.5	6	1,000	6	0.05	136,734	75,900	11.64	14
21	16.5	6	1,000	8	0.03	126,755	75,400	11.07	13.31

Ouput Table 2

Scenario	Initial WSE (Relative ft)	Initial Elev of Center of Breach (ft)	Breach Width (ft)	Failure Time (hrs)	Avg Failue Speed (ft/s)	Max Flow @ Dam (cfs)	Time of Peak Flow from Start of Breach (hrs)	Distance of 2 ft Limit from Reservoir Breach (ft)	Velocity at 2 ft Limit (ft/sec)	Outlfow Velocity At End of Assumed Failure Time (ft/s)	Reservoir Elevation At End of Assumed Failure Time (Relative ft)
1	16.5	0	5,000	6.92	0.2	323,406	4.00	82,300	0.51	3.49	8.78
2	16.5	0	5,000	4.63	0.3	369,949	2.75	82,300	0.51	4.23	10.12
3	16.5	0	5,000	3.47	0.4	407,460	2.25	82,300	0.51	4.85	11.13
4	16.5	0	5,000	2.77	0.5	437,986	2.00	82,300	0.51	5.32	11.85
5	16.5	0	6,000	8.33	0.2	333,620	4.25	82,000	0.5	2.7	7.7
6	16.5	0	6,000	5.55	0.3	386,793	3.00	82,000	0.5	3.42	8.9
7	16.5	0	6,000	4.16	0.4	424,603	2.50	82,100	0.5	4.04	10.29
8	16.5	0	6,000	3.33	0.5	456,792	2.00	82,000	0.5	4.4	10.91
9	16.5	0	7,000	9.72	0.2	342,081	4.50	81,200	0.51	2.13	6.81
10	16.5	0	7,000	6.48	0.3	401,108	3.25	81,600	0.5	2.8	8.31
11	16.5	0	7,000	4.86	0.4	440,632	2.50	81,300	0.51	3.25	9.24
12	16.5	0	7,000	3.88	0.5	476,539	2.25	81,300	0.51	3.67	10
13	16.5	0	8,000	11.11	0.20	343,597	5.00	80,400	0.51	1.66	5.91
14	16.5	0	8,000	7.4	0.30	411,411	3.50	80,700	0.51	2.24	7.41
15	16.5	0	8,000	5.56	0.40	453,205	2.75	80,700	0.51	2.66	8.2
16	16.5	0	8,000	4.44	0.50	490,455	2.25	80,900	0.51	3.1	9.27
17	16.5	0	9,000	12.5	0.20	336,759	5.25	79,800	0.51	1.36	5.39
18	16.5	0	9,000	8.3	0.30	413,246	3.75	79,900	0.51	1.76	6.51
19	16.5	0	9,000	6.25	0.40	462,602	3.00	79,900	0.51	2.19	7.57
20	16.5	0	9,000	5	0.50	502,964	2.50	79,900	0.51	2.52	8.32

Mannings	0.13										
4B	16.5	0	5,000	2.77	0.5	494,854	2.75	79,800	1.18	10.77	10.8

Ouput Table 3

Scenario	Initial WSE (Relative ft)	Initial Elev of Center of Breach (ft)	Breach Width (ft)	Failure Time (hrs)	Avg Failue Speed (ft/s)	Max Flow @ Dam (cfs)	Time of Peak Flow from Start of Breach (hrs)	Distance of 2 ft Limit from Reservoir Breach (ft)	Velocity at 2 ft Limit (ft/sec)	Outlfow Velocity At End of Assumed Failure Time (ft/s)	Reservoir Elevation At End of Assumed Failure Time (Relative ft)
1	16.5	0	500	6.92	0.02	75,702	7.00	61,300	0.48	13.96	14.91
2	16.5	0	1,000	13.88	0.02	102,000	13.00	75,200	0.49	9.47	11.37
3	16.5	0	1,000	9.26	0.03	120,931	9.25	75,400	0.49	10.62	12.76
4	16.5	0	1,000	6.94	0.04	131,844	7.00	75,400	0.49	11.19	13.46
5	16.5	0	1,000	5.55	0.05	139,134	5.50	75,700	0.49	11.5	13.85
6	16.5	0	1,500	20.83	0.02	112,299	14.00	78,100	0.49	5.65	8.26
7	16.5	0	1,500	13.89	0.03	125,520	11.00	78,700	0.49	6.99	9.87
8	16.5	0	1,500	10.42	0.04	143,169	9.25	78,800	0.5	7.96	10.98
9	16.5	0	1,500	8.33	0.05	157,697	7.75	78,900	0.5	8.58	11.68
10	16.5	0	2,000	27.77	0.02	116,394	11.50	79,300	0.49	3.55	6.22
11	16.5	0	2,000	18.51	0.03	137,224	8.75	80,100	0.5	4.58	7.74
12	16.5	0	2,000	13.89	0.04	137,224	8.75	80,200	0.5	5.3	8.74
13	16.5	0	2,000	11.11	0.05	146,443	6.75	80,200	0.5	6.16	9.89
14	16.5	0	1,500	4.16	0.10	200,729	4.25	79,000	0.5	10.31	13.6
15	16.5	0	1,500	2.08	0.20	228,098	2.25	79,000	0.5	11.15	14.62
16	16.5	0	2,000	5.55	0.10	213,261	5.75	80,400	0.5	8.09	12.28
17	16.5	0	2,000	2.77	0.20	261,434	2.75	80,700	0.5	9.57	13.93

Ouput Table 4

Preliminary Dam Break Results

Scenario	Initial WSE (Relative ft)	Breach Width (ft)	Failure Time (hrs)	Max Flow at Dam (cfs)	Distance of 2 ft Limit from Reservoir Breach (ft)	Outlfow Velocity At End of Assumed Failure Time (ft/s)	Reservoir Elevation At End of Assumed Failure Time (Relative ft)
1	16.5	1,500	20.83	112,299	78,100	5.65	8.26
2	16.5	1,500	13.89	125,520	78,700	6.99	9.87
3	16.5	1,500	10.42	143,169	78,800	7.96	10.98
4	16.5	1,500	8.33	157,697	78,900	8.58	11.68
5	16.5	2,000	11.11	146,443	80,200	6.16	9.89

Ouput Table 5

Scenario	Initial WSE (Relative ft)	Initial Elev of Center of Breach (ft)	Breach Width (ft)	Failure Time (hrs)	Avg Failue Speed (ft/s)	Max Flow @ Dam (cfs)	Depth During Max Flow @ Highway 27 (ft)	Time of Peak Flow from Start of Breach (hrs)	Distance of 2 ft Limit from Reservoir Breach (ft)	Velocity at 2 ft Limit (ft/sec)	Outlfow Velocity At End of Assumed Failure Time (ft/s)	Reservoir Elevation At End of Assumed Failure Time (Relative ft)
Sunny	12	0	1,500	8.33	0.05	96,670	8.67	6.75	60,100	0.45	6.61	9
PMP	18	0	2,000	11.11	0.05	185,408	11	8.25	88,000	0.42	6.68	9.54
Confined Flow (600 ft)	18	0	"1500/600"	8.333	0.05	37,530	17	3.00	66,300	0.43	3.42	16.52
Confined Flow (2000 ft)	18	0	2,000	11.11	0.05	101,945	15	6.25	95,000	0.4	2.7	13.76
PMP Expansion 4:1	18	0	2,000	11.11	0.05	183,804	11.75	7.50	102,900	0.41	5.97	10.73
PMP Expansion 2:1	18	0	2,000	11.11	0.05	195,222	10	8.50	70,200	0.46	7.94	10.3
PMP Expansion 3:1, Man=.1	18	0	2,000	11.11	0.05	108,997	15	6.25	84,600	0.2	2.82	13.54